Province of British Columbia
Ministry of Forests and Lands

PesTopics

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MOUNTAIN PINE BEETLE
A MENACE TO PINE FORESTS

The mountain pine beetle, Dendroctonus ponderosae (Hopkins), is the most destructive pest of lodgepole pine, Pinus contorta, in British Columbia. Outbreaks of this pest have been recorded in the pr e at irregular intervals since 1910.

The current problems were first detected in the early 1970s in several areas and a large infestation was active in the United States bordering the Flathead River Valley in southeastern British Columbia. Little was done to control these incipient spots and they rapidly expanded and coalesced. By 1978, 82 000 hectares (ha) were infested in the interior and during the period 1980 - 1984 losses averaged one-third of a million ha and 12 million cubic metres annually.

HOSTS AND DISTRIBUTION

Large diameter, mature and over-mature lodgepole pine are by far the most commonly affected tree species followed by western white-pine, Pinus monticola, occasionally ponderosa pine, Pinus ponderosa, and other pines, and rarely, other species. During outbreaks, immature trees with small diameters are also attacked. This beetle occurs throughout the range of lodgepole pine in British Columbia.

DESCRIPTION AND LIFE CYCLE

The typical one year life cycle (Figure 1) starts with the emergence of new adults in mid to late July. Adults select and infest green trees, bore through the bark to the sapwood and construct vertical egg galleries. Eggs are laid in niches along the sides of the gallery (Figure 2). Eggs hatch within a week or so and larvae may reach the third and fourth instars before they go into dormancy due to cold weather. They resume feeding in April, completing larval development in June. Larvae pupate within cells excavated in the bark and sapwood. Pupae transform into adults during mid-summer. New adults feed on fungus lining the pupal cell prior to emergence. The adults carry a blue-stain fungus into the sapwood which, along with gallery construction, girdles and kills the tree. Major

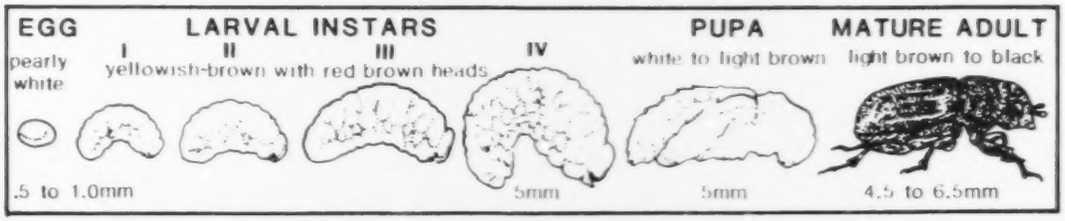

Fig. 1. Life stages of the mountain pine beetle
(Figure courtesy Canadian Forestry Service)

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causes of natural beetle mortality include predators, parasites and temperature extremes.

The most common deviation to the one-year life cycle is a two-year cycle, particularly at high elevations and near the northern edges of the beetle's distribution range where development is slowed by colder temperatures and new adults emerge two years after initial attack. Changes in the life cycle may result in shifts in the distribution of the various brood stages and damage symptoms within local areas.

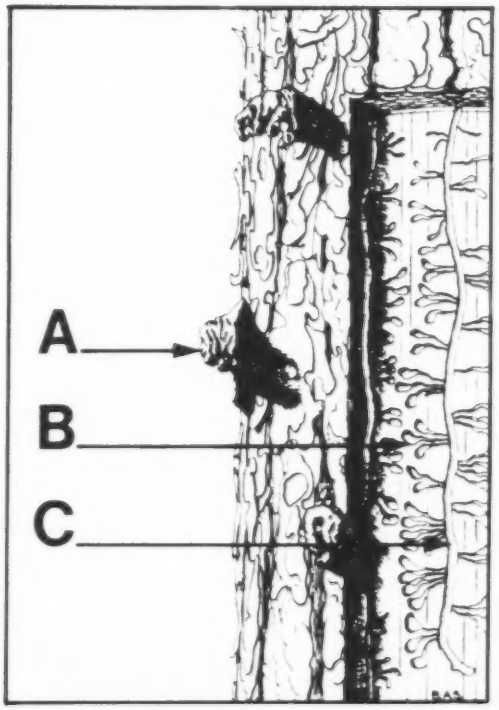

Fig. 2. Mountain pine beetle in lodgepole pine
A - pitch tube on trunk
B - larval gallery
C - egg gallery

(Figure courtesy Canadian Forestry Service)

DAMAGE SYMPTOMS

Damage symptoms include reddish-coloured boring dust at the base of freshly attacked trees and pitch tubes (Figure 2), 1.3 - 1.9 cm across, which usually form around entrance holes on the bark in the summer of attack. Bark removal by woodpeckers is often visible during the first winter after attack.

The damage is usually classified by foliage colouration which is a reflection of when attacks occur:

GREEN ATTACK - needles remain green for the remainder of the year following attack and part of the next. Larvae are present.

RED ATTACK - needles turn yellowish, then red the summer after attack. Red foliage may remain on lodepole pine for several years before falling. Larvae are not usually present.

GREY - needles usually fall off the tree during the second year after an attack. No larvae are present and all adults have flown. Exit holes in the bark and empty beetle galleries are present.

CONTROL

Management of pine forests to reduce or prevent losses may be categorized in two ways: long-term management strategies designed to reduce stand susceptibility over several rotations and limit the size of infestations that do occur, and, short-term direct control strategies designed to retard the expansion of infestations and provide time to implement more long-term solutions.

Some long-term approaches include: harvesting pine at a younger age, creating age and tree species mixes

over a management area; and, development of access to permit management. The extensive inventories of susceptible stands have considerably hampered long-term management efforts to the extent that most management efforts have centered around direct control activities.

To achieve direct control, the following requirements must be met: (1) control action must be initiated early in the infestation; (2) all techniques must be used in a coordinated, thorough manner; and, (3) control action must be maintained until there is no evidence of infestation or until other management options are exercised. Direct control strategies include the following:

I. SANITATION LOGGING

harvesting currently infested stands is the most efficient and effective method of removing a significant portion of a beetle population. Costs associated with this treatment include initial detection and assessment surveys to priorize stands and the use of aggregating pheromones (see PesTopic #12) to reduce dispersal of the beetle population.

II. SINGLE TREE TREATMENTS

are effective for disposing of isolated patches of attacked pine, mopping up infested trees around the periphery of cutblocks and suppressing incipient infestations in timber where cutting is not scheduled within two to three years. These treatments include:

a) Fall and Burn (Figure 3) - infested trees are felled, leaving low stumps. The attacked portions of the trees are cut into lengths, piled over stumps and burned. Although labour intensive, this technique is effective any time between attack and emergence of the young beetles. Fire hazard conditions usually necessitate that falling and burning activity be conducted from October to April only.

Fig. 3. Fall and Burn operations in the Cariboo Forest Region

b) Post-attack Injection of MSMA Insecticide - trees newly infested may be treated with MSMA* if done within three weeks of attack. The chemical is placed in a continuous shallow axe frill around the tree near the base. Translocation of this organic arsenical will kill the beetles and their brood under the bark.

c) Insecticide Spray Treatments - infested trees are felled, bucked when necessary, and the attacked portions are sprayed uniformly to the drip point with a bark penetrating solution of a registered insecticide. Applications of insecticides can also be made to the lower 3 m of healthy standing trees of high value to prevent attack.

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* Monosodium methane arsenate (Glowon®), 320 g/L a.i.

III. PRESCRIBED BURNING
may be used in critical, inaccessible infestations where unchecked infestations will threaten the surrounding pine stands. This option is not often used, but should be considered in specific instances.

IV. PHEROMONES
synthetic aggregation pheromones may be used to attract beetles to selected trees and thereby induce mass attacks (see PesTopic #12). Pheromones may be used for the following purposes:

a) Containment and concentration to prevent beetles dispersing to new areas:
   i) where infested stands cannot be logged in the current year;
   ii) in lightly-infested or uninfested stands of high hazard prior to logging.
b) Post-logging mop-up of residual infestations to concentrate any remaining beetles around baited trees. These trees are then treated or removed to kill beetles.
c) Elimination of spot infestations by improving the efficiency of single tree treatments.
d) Monitoring, to determine when beetles are flying and to implement log transportation restrictions during critical flight periods.
e) Millyard sanitation of beetles.

CONCLUSION

The mountain pine beetle poses a serious threat to B.C.'s pine forests. These forests have to be effectively managed to prevent a permanent loss of timber, jobs and revenue. Pine must therefore be managed with the potential for bark beetles kept in mind.

Access development, harvest prescriptions, and all other techniques must be applied properly to avoid or minimize future losses.

ADDITIONAL READING

Amman, G.D., M.D. McGregor, D.B. Cahill, and W.H. Klain. 1977. Guidelines for reducing losses of lodgepole pine to the mountain pine beetle in unmanaged stands in the Rocky Mountains. U.S.D.A. For. Serv. Gen. Tech. Rept. INT-36. 19 pp.

B.C. Ministry of Forests and Lands. 1987. Bark Beetles - A Threat to Our Forest. B.C. Min. Forests Pest Management Rep. In preparation.

Cole, W.E. and G.D. Amman. 1980. Mountain pine beetle dynamics in Lodgepole pine forests Part I: Course of an infestation. U.S.D.A. For. Serv. Gen. Tech. Rept. INT-89. 56 pp.

Hall, P.M. and T. F. Maher (Eds) 1986. Mountain Pine Beetle Symposium Proceedings - Smithers, April 16 - 18, 1985. B.C. For. Serv. Pest Mngmnt. Rept. 7. 158 pp.

McMullen, L.H., L. Safranyik and D. A. Linton. 1986. Suppression of mountain pine beetle infestations in lodgepole pine forests. Can. For. Serv. Inf. Rept. B.C.-X-276. 20 pp.

Safranyik, L., D.M. Shrimpton, and H.S. Whitney. 1974. Management of lodgepole pine to reduce losses from the mountain pine beetle. Envir. Can. For. Serv. Tech. Rep. 1. Victoria, B.C. 24 pp.